REMARKS

Claims 1, 3-10, 12, 13, 18, 21, 22, 25 and 26 are all the claims pending in the application.

Claims 1, 3-10, 12, 13, 18, 21, 22, 25 and 26 have been rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-18 of U.S. Patent No. 7,132,176 to Iwasaki et al for the reasons set forth in Paragraph 6 of the Office Action of June 19, 2007, which refers back to Paragraph 5 of the Office Action of January 8, 2007.

In response, applicants enclose herewith an executed Terminal Disclaimer.

Applicants request withdrawal of this rejection in view of the filing of the Terminal Disclaimer.

Claim 3 has been objected to because of a typographical error. Applicants have amended claim 3 to correct this typographical error.

Claims 1, 3-7, 12, 13, 18, 21, 22 and 26 have been rejected under 35 U.S.C. § 102(a) as obvious over WO 2003/009280 to Mukai in view of U.S. Patent 6,562,481 to Kaitsu et al and U.S. Patent 6,468,670 to Ikeda et al.

The Examiner cites U.S. Patent 7,132,177 to Mukai as an English language equivalent of WO '280, and in his discussion of the Mukai reference refers to the U.S. Mukai patent. In the following discussion, applicants also will refer to the Mukai U.S. patent.

Applicants submit that these documents do not disclose or suggest the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

The present invention, as set forth in claim 1 as amended above, is directed to a magnetic recording medium comprising a nonmagnetic substrate, and at least three layers formed on the

nonmagnetic substrate. The at least three layers are comprised of a non-magnetic orientation-controlling layer for controlling orientation of a layer formed directly thereon, a perpendicular magnetic layer having an easily magnetizing axis oriented mainly perpendicularly relative to the nonmagnetic substrate, and a protective layer.

The perpendicular magnetic layer comprises two or more magnetic layers, wherein at least one of the magnetic layers is a lower layer having Co as a main component and containing Pt and an oxide and at least another of the magnetic layers is an upper layer having Co as a main component and containing Cr and no oxide. The lower magnetic layer is directly adjacent and in contact with the orientation-controlling layer and comprises magnetic crystal grains isolated by the oxide and dispersed in the lower layer, and the crystal grains vertically penetrate the lower layer in columnar forms. The upper layer comprises magnetic crystal grains that are formed and epitaxially grown on the magnetic crystal grains of the lower layer in a ratio of one to one on an upper surface of the lower layer.

Thus, applicants have amended claim 1 to recite that in the upper layer, magnetic crystal grains are formed in a ratio of one to one on the columnar magnetic crystal grains of the upper surface of the lower layer. Support for this amendment can be found at, for example, page 6, lines 10-15 and page 17, lines 16-18. Applicants have made a similar amendment to independent method claim 18.

Therefore, the perpendicular magnetic layer of the magnetic recording medium according to the present invention has a structure comprising columnar magnetic crystal grains isolated by an oxide and dispersed (a so-called granular structure) in the lower layer, and comprises a lower layer perpendicularly penetrated by the columnar magnetic crystal grains and an upper layer of

magnetic crystal grains formed in a ratio of one to one on the columnar magnetic crystal grains on the upper surface of the lower layer.

Since the magnetic recording medium of the present invention has the crystal grains of the upper layer formed in a ratio of one to one on the crystal grains of the lower layer, the crystal grains of the upper layer are refined to enhance the crystallinity and orientation thereof. See page 17, lines 19-22, the original specification.

With this configuration, the magnetic recording medium of the present invention can acquire recording and reproducing properties suitable for high-density recording. See page 18, lines 21-24, of the original specification.

The Examiner states that Mukai discloses all of the features of the present claims, except that Mukai does not specifically disclose that the recording medium possesses perpendicular magnetic layers having an easy magnetizing axis oriented mainly perpendicular relative to the nonmagnetic substrate, and that Mukai does not disclose that the lower magnetic layer possesses crystal grains that vertically penetrate the lower layer in columnar form.

The Examiner cites Ikeda et al for a teaching of a two layered magnetic recording medium comprising a lower granular layer (a CoCr layer) and an upper non-granular (continuous) layer, wherein both layers are perpendicular magnetic layers. The Examiner argues that it would have been obvious to modify the Mukai device to employ perpendicular magnetic layers in view of Ikeda et al.

With respect to the recitation in the present claims that the lower magnetic layer has crystal grains that vertically penetrate the lower layer in columnar form, the Examiner states that Fig. 1 of Ikeda et al appears to disclose such a feature.

With respect to the recitation that the lower magnetic layer of the present invention comprises crystal grains that vertically penetrate the lower layer in columnar form, the Examiner further relies on Kaitsu et al for teaching the forming of columnar grains in Co oxide magnetic layers as being beneficial with respect to medium SNR, thermal stability, and recording density. The Examiner states that while Kaitsu et al refer to a circumferential orientation for the easy axis of magnetization of the magnetic layer, they do not exclude perpendicular magnetic layers.

Applicants submit that Mukai, Ikeda et al and Kaitsu et al do not render obvious the present invention.

Mukai discloses a magnetic recording medium equipped with a first magnetic layer and a second magnetic layer. See Figures 1, 2A to 2E, 3 and 4.

However, Mukai does not disclose or suggest that the upper magnetic layer is constituted by magnetic crystal grains formed in a ratio of one to one with respect to the magnetic crystal grains constituting the lower magnetic layer. Accordingly, Mukai does not disclose or suggest the subject matter of the claims as amended above which recite a one to one ratio.

Further, the Examiner states at the bottom of page 5 to line 1 of page 6 of the Office Action that Mukai discloses that the "lower magnetic layer . . . [comprises] magnetic crystal grains isolated by the oxide and dispersed in the lower layer." The Examiner states that such an

arrangement is "deemed necessarily present in the disclosed Co-oxide magnetic layers, but see also col. 3, lines 1-8."

However, the Examiner does not explain why he believes that such an arrangement is necessarily present. In addition, column 3, lines 1-8 of Mukai to which the Examiner has referred does not contain such a disclosure. Instead, Mukai discloses at column 3, lines 1-8, that "a portion of the magnetic layer may be made of a mixture of Co based magnetic substance and oxide or nitride" and that the "oxide and nitride prevent magnetic grains from expanding." Thus, the configuration of the "lower layer" as indicated by the Examiner is not disclosed therein.

Still further, Mukai describes at column 4, lines 64-67, that the content ratio of oxide and nitride in the magnetic layers 13 and 14 in Figure 1 "is not as high as that of a granular film."

Thus, Mukai neither discloses nor suggests that the lower magnetic layer is configured with a granular structure.

Turning now to Ikeda et al, this patent discloses a magnetic recording disc comprising a first layer that is a CoCr granular layer and a second layer formed on the granular layer. See column 2, lines 12-17, and Figure 2.

However, Ikeda et al fail to disclose or suggest that crystal grains different in composition from the crystal grains constituting the CoCr granular layer are formed in a ratio of one to one on the crystal grains of the CoCr granular layer to form the second layer. Accordingly, Ikeda et al do not supply the deficiencies of Mukai.

Kaitsu et al also do not supply the deficiencies of Mukai. Kaitsu et al disclose a magnetic recording medium comprising a primary layer 2 formed of an alloy having a body-centered cubic

structure, a magnetic recording layer 3 perpendicularly penetrated in the thickness direction by plural columnar ferromagnetic crystal grains 3_1 which are dispersed in an SiO_2 matrix 3_2, and a protective layer protecting the recording layer and formed of carbon. See column 7, line 65 to column 8, line 1, column 8, lines 6-10, 30-32 and 46-47, and Figure 3.

However, the protective layer 4 of Kaitsu et al which is on the recording layer has no magnetism. Thus, Kaitsu et al do not disclose an upper magnetic layer which is formed on the magnetic recording layer.

In addition, Kaitsu et al do not describe that the recording layer 3 is formed on the primary layer 2 so that the ferromagnetic crystal grains 3_1 of the recording layer are formed in a ratio of one to one on the crystal grains constituting the primary layer 2.

As can be seen from the above discussion, the present invention differs in configuration from the cited documents.

In summary, none of the cited documents discloses or suggests that a perpendicular magnetic layer of a magnetic recording medium comprises a lower layer of a granular structure formed of magnetic crystal grains isolated by an oxide and dispersed in the lower layer, and an upper layer formed of magnetic crystal grains formed in a ratio of one to one on the crystal magnetic grains of the lower layer and formed on an upper surface of the lower layer.

In view of the above, applicants submit that the present claims are patentable over the cited documents and, accordingly, request withdrawal of this rejection.

Claims 8-10 have been rejected under 35 U.S.C. §103(a) as obvious over Mukai in view of Ikeda et al and Kaitsu et al, and further in view of U.S. Patent 5,991,126 to Hayashi et al.

In general, the Examiner states that Mukai does not disclose the specific alloy for the upper perpendicular magnetic layer that is recited in claims 8-10.

The Examiner states that Hayashi et al teach that the composition of a perpendicular magnetic film is a known results effective variable, and that it is known in the art to form high output, high recording density perpendicular magnetic films from CoCrPt-M alloys that have the claimed composition and atomic % recitations. The Examiner particularly refers to col. 1, line 11 to col. 2, line 5 and col. 4, line 25-54 of Hayashi et al.

Claims 8-10 are dependent claims that depend from claim 1. Accordingly, applicants rely on the above arguments they presented for the patentability of claim 1.

Further, Hayashi et al disclose at column 3, lines 25-29, a magnetic recording medium 2 comprising an auxiliary magnetic layer 7, an orientation control layer 5, a perpendicular magnetic film 1 and a protective/lubricative layer 8 formed on a nonmagnetic base 6, in the order mentioned.

However, Hayashi et al do not disclose that the auxiliary magnetic layer 7, orientation control layer 5 and perpendicular magnetic film have a granular structure.

In addition, Hiyashi et al do not disclose any relationship of the disposition between the crystal grains constituting the orientation control layer 5 and the crystal grains constituting the perpendicular magnetic layer 1 formed on the orientation control layer 5, and do not disclose any relationship of the disposition between the crystal grains constituting the orientation control layer 5 and the crystal grains constituting the auxiliary magnetic layer 7 formed under the orientation control layer 5.

Therefore, Hayashi et al do not supply the deficiencies of Mukai.

In view of the above, applicants request withdrawal of this rejection.

Claim 25 has been rejected under 35 U.S.C. §103(a) as obvious over Mukai in view of Ikeda et al and Kaitsu et al, and further in view of U.S. Pub. Patent Appln. No. 2003/0134151 to Usuki et al.

Claim 25 depends from claim 18. Accordingly, applicants submit that claim 25 is patentable for the same reasons as claim 18 as discussed above.

Usuki et al disclose a magnetic recording medium that contains a primer layer as a lower layer on which an oxide-containing magnetic layer can be formed in a column-like structure. As disclosed in paragraph [0039] of Usuki et al, the magnetic layer comprises a cobalt-containing ferromagnetic metal alloy and a non-magnetic oxide. The primer layer can be a Cr-containing layer or a ruthenium-containing layer.

In one embodiment of their invention, Usuki et al disclose in paragraph [0108] and in Figs. 3(A) and 4(A), a flexible disc 21 having a chromium-containing primer layer 25A on each of the surfaces of a polymer support member, and a magnetic layer 26 formed on each chromium-containing primer layer 25A. The magnetic layer 26 comprises a nonmagnetic material 30 and a ferromagnetic alloy 29 that contains at least cobalt, platinum and chromium.

However, Usuki et al neither disclose nor suggest a method for producing a magnetic recording medium containing a perpendicular magnetic layer of the present invention by forming a lower magnetic layer having magnetic crystal grains isolated by an oxide, dispersed in the lower layer and penetrating the lower layer in columnar form, and forming an upper magnetic

layer containing no oxide and having magnetic crystal grains on the magnetic crystal grains of the lower magnetic layer.

In view of the above, applicants submit that claim 25 is patentable over the cited documents and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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